

APPLICATION

FOR UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT I, **Ronald J. Hoffart**, a citizen of the United States,
have invented a new and useful implement mounting system of which the following is
a specification:

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2
3 **Implement Mounting System**
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6 **CROSS REFERENCE TO RELATED APPLICATIONS**

7 Two other utility patent applications are being filed with the USPTO
8 simultaneously with this application identified by Attorney Docket Numbers GROU-011
9 and GROU-012.
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12 **STATEMENT REGARDING FEDERALLY**
13 **SPONSORED RESEARCH OR DEVELOPMENT**

14 Not applicable to this application.
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17 **BACKGROUND OF THE INVENTION**
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21 **Field of the Invention**
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23 The present invention relates generally to implement mounting arrangements
24 for tractors and similar vehicles, and more specifically it relates to an implement
25 mounting system for providing a lightweight structure capable of moving along 3 main
26 axes for use upon small to mid-sized tractors.
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1 **Description of the Related Art**

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3 Conventional implement mounting arrangements have been in use for years for
4 mounting various types of implements to tractors and like vehicles. Implements
5 mounted to these structures range from loaders, blades, belly blades, rollers, brushes
6 and the like. A typical implement mounting arrangement is the front-end loader
7 commonly utilized upon small to large tractors.

8
9 Another type of implement mounting arrangement is comprised of a belly
10 structure that is attached beneath the frame of a tractor preferably capable of operating
11 about various axes to provide lift, roll, pitch and yaw to an implement. The belly
12 structure typically has a support frame with side members and a rear support, a pair of
13 support arms pivotally extending forwardly from the rear support, and an attachment
14 structure that is movably attached to the distal portions of the support arms by a
15 connecting structure. The connecting structure sometimes rotatably positioned within
16 the support arms to allow for "rolling" of the implement. A pair of vertical actuators
17 are attached on opposing sides to the connecting structure to provide both lift and roll
18 to the belly mounting structure. U.S. Patent No. 6,059,048 illustrates a recently
19 patented belly mounting structure design that has these features and the below inherent
20 limitations.

21
22 The main problem with conventional belly mounting structures is that they
23 require the user to mount the vertical actuators to the front portion of the tractor
24 thereby interfering with attachment of a conventional front-end loader (conventional
25 front-end loaders are attached to the front portion of the tractor frame). Another
26 problem with conventional belly mounting structures is that they tend to be heavy and
27 bulky since they have at least two support arms extending forwardly from the rear
28 support. A further problem with conventional belly mounting structures is that they

1 require the usage of heavy duty pivot joints and materials near the front portion
2 thereof.

3
4 While these devices may be suitable for the particular purpose to which they
5 address, they are not as suitable for providing a lightweight structure capable of
6 moving along 3 main axes. Conventional implement mounting devices are bulky and
7 difficult to utilize upon small to mid-sized tractors.

8
9 In these respects, the implement mounting system according to the present
10 invention substantially departs from the conventional concepts and designs of the prior
11 art, and in so doing provides an apparatus primarily developed for the purpose of
12 providing a lightweight structure capable of moving along 3 main axes.

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2 **BRIEF SUMMARY OF THE INVENTION**

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4 In view of the foregoing disadvantages inherent in the known types of belly
5 mounting structures now present in the prior art, the present invention provides a new
6 implement mounting system construction wherein the same can be utilized for
7 providing a lightweight structure capable of moving along 3 main axes for use upon
8 small to mid-sized tractors.

9

10 The general purpose of the present invention, which will be described
11 subsequently in greater detail, is to provide a new implement mounting system that has
12 many of the advantages of the belly mounting structures mentioned heretofore and
13 many novel features that result in a new implement mounting system which is not
14 anticipated, rendered obvious, suggested, or even implied by any of the prior art belly
15 mounting structures, either alone or in any combination thereof.

16

17 To attain this, the present invention generally comprises a support frame having
18 a pair of side supports and a rear support, a ball joint attached to the rear support, and a
19 support arm movably attached to the ball joint for rotating about 3 main axes. A brace
20 member is attached between the support frame and the support arm for reducing the
21 amount of side-to-side movement of the support arm. The ball joint is comprised of a
22 ball-and-socket structure for providing various pivoting movements of the support
23 arm.

24

25 There has thus been outlined, rather broadly, the more important features of the
26 invention in order that the detailed description thereof may be better understood, and
27 in order that the present contribution to the art may be better appreciated. There are
28 additional features of the invention that will be described hereinafter and that will form
29 the subject matter of the claims appended hereto.

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In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

A primary object of the present invention is to provide an implement mounting system that will overcome the shortcomings of the prior art devices.

A second object is to provide an implement mounting system for providing a lightweight structure capable of moving along 3 main axes for use upon small to mid-sized tractors.

Another object is to provide an implement mounting system that may be utilized upon various types and sizes of vehicles.

An additional object is to provide an implement mounting system that is capable of supporting various types of implements such as but not limited to a belly blade, plow, a roller and a brush.

A further object is to provide an implement mounting system that does not interfere with a front-end loader attached to a tractor.

Another object is to provide an implement mounting system that is comprised of a simple structure and simple to attach to a tractor.

1 Other objects and advantages of the present invention will become obvious to the
2 reader and it is intended that these objects and advantages are within the scope of the
3 present invention.

4
5 To the accomplishment of the above and related objects, this invention may be
6 embodied in the form illustrated in the accompanying drawings, attention being called
7 to the fact, however, that the drawings are illustrative only, and that changes may be
8 made in the specific construction illustrated and described within the scope of the
9 appended claims.

10

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

FIG. 1 is a top view of the present invention.

FIG. 2 is an upper perspective view of the present invention.

FIG. 3 is a rear perspective view of the present invention illustrating the rolling of the implement upwardly on the left side.

FIG. 4 is a rear perspective view of the present invention illustrating the rolling of the implement upwardly on the right side.

FIG. 5 is a side view of the present invention in an elevated position.

FIG. 6 is a side view of the present invention in a lowered position.

FIG. 7 is an upper perspective view of the present invention.

FIG. 8 is a top view of the present invention.

FIG. 9 is a cross sectional view taken along line 9-9 of Figure 8.

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2 **DETAILED DESCRIPTION OF THE INVENTION**

3

4 **A. *Overview***

5 Turning now descriptively to the drawings, in which similar reference
6 characters denote similar elements throughout the several views, FIGS. 1 through 9
7 illustrate an implement mounting system 10, which comprises a support frame 20
8 having a pair of side supports 24 and a rear support 22, a ball joint 40 attached to the
9 rear support 22, and a support arm 30 movably attached to the ball joint 40 for rotating
10 about 3 main axes. A brace member 50 is attached between the support frame 20 and
11 the support arm 30 for reducing the amount of side-to-side movement of the support
12 arm 30. The ball joint 40 is comprised of a ball-and-socket structure for providing
13 various pivoting movements of the support arm 30.

14

15 **B. *Support Frame***

16 As shown in Figures 1 through 6 of the drawings, a support frame 20 is
17 preferably utilized with the present invention. The support frame 20 is preferably
18 attached to the belly of a tractor or other related vehicle. The support frame 20 is
19 preferably formed so as to not interfere with a front-end loader or other attachment to
20 the front of the tractor. The support frame 20 may have various structures capable of
21 mounting to a tractor frame as can be appreciated.

22

23 As best shown in Figures 1 and 2 of the drawings, the support frame 20
24 preferably has a pair of side supports 24 and a rear support 22 attached between the
25 rear ends of the side supports 24. The side supports 24 are preferably attached to the
26 lower frame of the tractor utilizing conventional fasteners such as but not limited to
27 bolts and the like. Various other bracing and reinforcement structures may be utilized
28 to construct the support frame 20 other than shown in the attached drawings.

29

1 **C. *Ball Joint***

2 As shown in Figures 1 through 4 of the drawings, a ball joint 40 is provided for
3 movably supporting the support arm 30. The ball joint 40 is preferably comprised of a
4 ball-and-socket structure for providing various pivoting movements of the support arm
5 30. Figure 7 illustrates the three main axes of pivoting (X, Y and Z), however the ball
6 joint 40 inherently allows pivoting along various other axes.

7
8 The ball joint 40 may be attached directly to the tractor frame, however the ball
9 joint 40 is preferably attached directly to the support frame 20. The ball joint 40 may
10 be attached to the rear support 22 of the support frame 20 as shown in Figures 1
11 through 4 of the drawings.

12
13 A cuff structure 32 extending from the rear support 22 preferably engages the
14 ball joint 40 via a pin member as shown in Figures 1 through 6 of the drawings.
15 Alternatively, the cuff structure 32 may be attached to the first end of the support arm
16 30 as shown in Figures 7 and 8 of the drawings. The ball joint 40 allows the support
17 arm 30 to have three main movements: lift, roll and yaw.

18
19 The ball joint 40 is preferably centrally positioned along the rear support 22 as
20 best shown in Figures 3 and 4 of the drawings. However, the ball joint 40 may be
21 positioned at various other locations along the rear support 22.

22
23 **D. *Support Arm***

24 The support arm 30 is an elongate structure having a first end and a second end
25 as best shown in Figures 1 and 8 of the drawings. The first end of the support arm 30
26 is attached to the ball joint 40 as further shown in Figures 1 and 8 of the drawings.

27
28 The second end receives an attachment structure for an implement 12. The
29 attachment structure is capable of supporting various types of implements 12 such as

1 but not limited to blades, plows, brushes and the like. For example, a front joint 36 is
2 preferably attached to the second end of the support arm 30 for allowing pivoting of
3 the implement 12 independently of the movement of the support arm 30 such as pitch
4 and yaw.

5 6 ***E. Brace Member***

7 A brace member 50 is provided for stabilizing the horizontal side-to-side
8 movements of the support arm 30. The brace member 50 is preferably attached
9 between the support frame 20 and the support arm 30. However, the brace member 50
10 may be directly attached to the tractor frame.

11
12 The brace member 50 is preferably attached to the support frame 20 at a vertical
13 height substantially similar to the ball joint 40 as shown in Figures 2 and 7 of the
14 drawings. This allows for the uninterrupted vertical movement of the support arm 30
15 while limiting the horizontal movement of the support arm 30.

16
17 The brace member 50 has an angle with respect to the support arm 30 for
18 reducing side-to-side movement of the support arm 30 as best shown in Figures 1 and
19 8 of the drawings. The angle between the support arm 30 and the brace member 50 is
20 preferably less than seventy-five degrees and greater than ten degrees, though various
21 other angles may be utilized.

22
23 As shown in Figures 1 through 4 of the drawings, the brace member 50 is
24 preferably attached to the support frame 20 via a ball-and-socket joint. The brace
25 member 50 is also preferably attached to the support arm 30 via a ball-and-socket
26 joint.

1 ***F. Cross Member***

2 A cross member **34** is preferably attached transversely to the support arm **30** as
3 shown in Figures 1 through 8 of the drawings. The cross member **34** has an elongate
4 structure and has two opposing ear structures for receiving a pair of vertical actuators
5 **16** for allowing control of the lift and roll movements. The cross member **34** is
6 preferably attached to a central location upon the support arm **30** as shown in Figures 1
7 through 4 of the drawings.

8

9 The brace member **50** is attached near a distal end of the cross member **34**,
10 wherein the distal end of the cross member **34** is on an opposite side of the support
11 arm **30** of where the brace member **50** is attached to the support frame **20** as shown in
12 Figures 1 and 8 of the drawings. The brace member **50** may be attached to a bracket
13 member that is attached to the cross member **34** as best shown in Figure 4 of the
14 drawings.

15

16 ***G. Actuators***

17 As shown in Figure 1 of the drawings, a pair of horizontal actuators **14** are
18 preferably utilized within the present invention that control the yaw and pitch of the
19 implement **12** attached to the support arm **30**. The horizontal actuators **14** are
20 preferably attached to the support arm **30** near the first end thereof as shown in Figure
21 1 of the drawings.

22

23 A pair of vertical actuators **16** are preferably attached between the side supports
24 **24** of the support frame **20** (or the tractor frame) and the cross member **34** that control
25 the lift and roll of the implement **12** attached to the support arm **30**. The actuators **14**,
26 **16** are preferably connected with ball-and-socket joint structures to allow for free
27 movement of the support arm **30**. The actuators **14**, **16** are also preferably comprised
28 of hydraulic cylinders, however various other actuator structures may be utilized such
29 as but not limited to electrical actuators.

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H. Operation

In use, the support frame **20** is attached to a lower portion of a tractor frame. The desired implement **12** is attached to the distal second end of the support arm **30** as desired. The actuators are fluidly connected to the hydraulic system of the tractor or an independent hydraulic system.

If the user desires to lift/lower the implement **12**, the vertical actuators **16** are retracted/extended accordingly as shown in Figures 5 and 6 of the drawings. As the implement **12** is lifted/lowered, the support arm **30** freely pivots along the X axis of the ball joint **40** as shown in Figure 7 of the drawings. As the support arm **30** is lifted/lowered, the brace member **50** will apply a side-to-side horizontal force upon the support arm **30** which the ball joint **40** will allow the support arm **30** to accordingly move a finite distance to the side (pivoting along the Y axis of Figure 7). To reduce the amount of side-to-side movement caused by the brace member **50** during lifting/lowering, a longer brace member **50** is desired.

As shown in Figures 3 and 4 of the drawings, if the user desires to roll the implement **12**, the vertical actuators **16** are retracted/extended accordingly (usually by retracting one actuator and extending another actuator, however retracting/extending only one actuator will accomplish the same). As the implement **12** is lifted/lowered, the support arm **30** freely pivots along the Z axis of the ball joint **40** as shown in Figure 7 of the drawings.

If the user desires to change the pitch or yaw of the implement **12**, the horizontal actuators **14** are retracted/extended accordingly. Control of the pitch and yaw of the implement **12** does not affect the support arm **30**.

1 As to a further discussion of the manner of usage and operation of the present
2 invention, the same should be apparent from the above description. Accordingly, no
3 further discussion relating to the manner of usage and operation will be provided.

4
5 With respect to the above description then, it is to be realized that the optimum
6 dimensional relationships for the parts of the invention, to include variations in size,
7 materials, shape, form, function and manner of operation, assembly and use, are
8 deemed to be within the expertise of those skilled in the art, and all equivalent
9 structural variations and relationships to those illustrated in the drawings and
10 described in the specification are intended to be encompassed by the present invention.

11
12 Therefore, the foregoing is considered as illustrative only of the principles of
13 the invention. Further, since numerous modifications and changes will readily occur to
14 those skilled in the art, it is not desired to limit the invention to the exact construction
15 and operation shown and described, and accordingly, all suitable modifications and
16 equivalents may be resorted to, falling within the scope of the invention.